

CLAIMS

1. A method for the removal of an excess copper-containing material from a substrate comprising a copper layer, the process comprising:
 - providing the substrate comprising the copper layer and the excess copper-containing material disposed thereupon;
 - introducing the substrate into a vessel containing a chemical mechanical polishing mixture comprising a solution and a plurality of particles wherein the solution comprises an etchant, a modifier, and a surfactant and wherein an average particle diameter of the particles ranges from 100 to 3000 μm ; and
 - agitating the vessel with the substrate contained therein to remove the excess copper-containing material from the substrate.
2. The method of claim 1 wherein a solution to void volume ratio is one or less.
3. The method of claim 2 wherein the solution to void volume ratio is 0.2 or less.
4. The method of claim 1 wherein the solution is contacted with the plurality of particles for at least 8 hours prior to the introducing step.
5. The method of claim 1 wherein the agitating step is conducted by at least one member selected from the group consisting of vibratory motion, ultrasonic motion, pulsatory motion, sonic motion, acoustic motion, centrifugal motion, and combinations thereof.
6. The method of claim 1 wherein the agitating step is conducted by vibratory motion.

7. The method of claim 6 wherein the frequency of the vibratory motion ranges from 20 to 200 Hz..

8. The method of claim 6 wherein the amplitude of the vibratory motion ranges from 0.1 to 5 mm.

9. A method for the removal of an excess material from the surface of a substrate, the method comprising:

introducing the substrate into a vessel having a chemical mechanical polishing mixture comprising a chemical solution and a plurality of particles having an average particle diameter ranging from 100 to 3000 μm ; and

agitating the vessel with the substrate and the chemical mechanical polishing mixture contained therein to remove the excess material from the substrate.

10. A method for the removal of an excess copper-containing material from a substrate comprising a copper layer, the process comprising:

providing a chemical mechanical polishing mixture comprising a solution comprising an etchant, a modifier, and a surfactant and a plurality of non-abrasive particles wherein the average particle diameter ranges from 100 to 3000 μm and wherein a solution to void volume ratio is about 1 or less; and

contacting the substrate with the mixture to remove the excess copper-containing material from the substrate.

11. The method of claim 10 wherein the contacting step comprises:

introducing the substrate into a vessel containing the chemical mechanical polishing mixture; and

agitating the vessel with the substrate and the chemical mechanical polishing mixture contained therein to remove the excess copper-containing material from the substrate.

12. The method of claim 10 wherein the solution is contacted with the plurality of particles for at least 8 hours prior to the contacting step.

13. A chemical mechanical polishing mixture, the mixture comprising:
a solution comprising an etchant, a modifier, and a surfactant; and
a plurality of particles having an average particle diameter ranging from 100 to about 3000 μm .

14. The mixture of claim 13 wherein a solution to void volume ratio is about one or less.

15. The mixture of claim 13 wherein the solution further comprises a solvent.

16. The mixture of claim 13 wherein the plurality of particles is contacted with the solution for a duration of at least 8 hours.

17. The mixture of claim 13 wherein the etchant is at least one member selected from the group consisting of peroxides; inorganic acids or salts thereof; nitrates, halogen-containing compounds; sulphates; persulphates; and combinations thereof.

18. The mixture of claim 13 wherein the modifier is at least one member selected from the group consisting of organic acids; amines; nitrogen-containing cyclic compounds; and combinations thereof.

19. A chemical mechanical polishing mixture, the mixture comprising:
a solution comprising from about 0.1% to 20% by weight of an etchant, 0.1% to 15% by weight of a modifier, and 0.001% to 10% by weight of a surfactant, and 50 to 99% of a solvent; and

a plurality of particles with an average particle diameter ranging from 100 to 3000 μm ,

wherein a solution to void volume ratio is about one or less.

20. The mixture of claim 19 wherein the solution is contacted with the plurality of particles for at least 8 hours.

21. The mixture of claim 19 wherein the particles comprise non-abrasive particles.

22. The mixture of claim 19 wherein the particles are comprised of at least one member selected from the group consisting of aluminum oxide, silicon dioxide, silicon carbide, titanium oxide, magnesium oxide, zirconium oxide, porcelain, cerium oxide, and combinations thereof.